FUTURE READINESS ANALYSIS METHODOLOGY AND CAPABILITIES OVERVIEW

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AIR-4.10.1.3

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Agenda

- Warfare Analysis & Integration Department's
  - Mission
  - Vision
  - Role
  - M&S-Based Analysis Process
- Readiness Analysis
  - Role
  - M&S Based Analysis Process
- H-53 Application Example
  - Background
  - Evolution of an Excursion
  - Analytic Trade Space Considerations
  - Analytic Results
- Analysis
  - Approach/Methodology
  - Operational Resource Utilization Analysis Toolset
    - Aviation Maintenance Model (AMM)
    - Naval Aviation Maintenance Simulation Model (NAMSM)
- Other Programmatic Examples
- Readiness in the Systems Engineering and the Acquisition Process
- Benefits
- Questions

Warfare Analysis & Integration Department

- **Mission:** Evaluate and quantify the effectiveness of naval aviation technologies, systems, and capabilities in the operational battlespace
  - Provide the entry point for operational systems and warfare analysis at NAVAIR as part of the NAE Integrated Analysis Team
  - To provide readiness MS&A expertise in support of all levels of warfare analysis

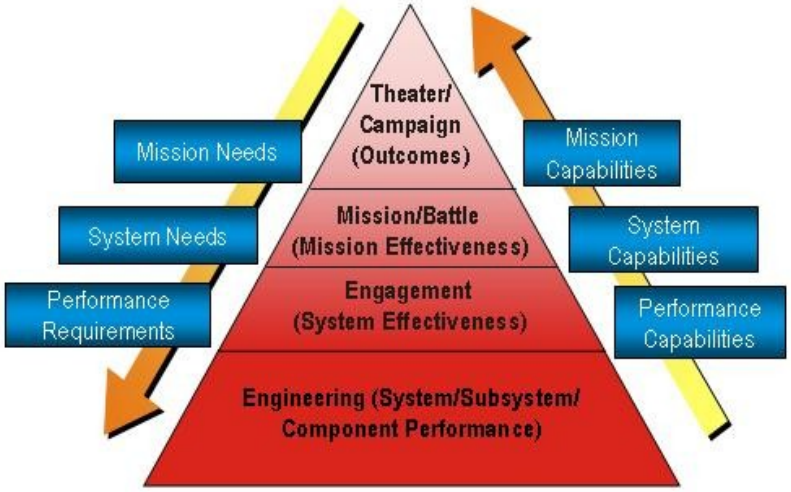
- **Vision:** Stand nationally recognized as the authoritative source for Naval Aviation operational systems analysis, warfare analysis and source selection to improve decisions by leadership providing needed capabilities to the warfighter

Support Fact-based Decision Making for the Acquisition & Sustainment of Naval Aviation Systems in projected operational environments through Readiness Analysis

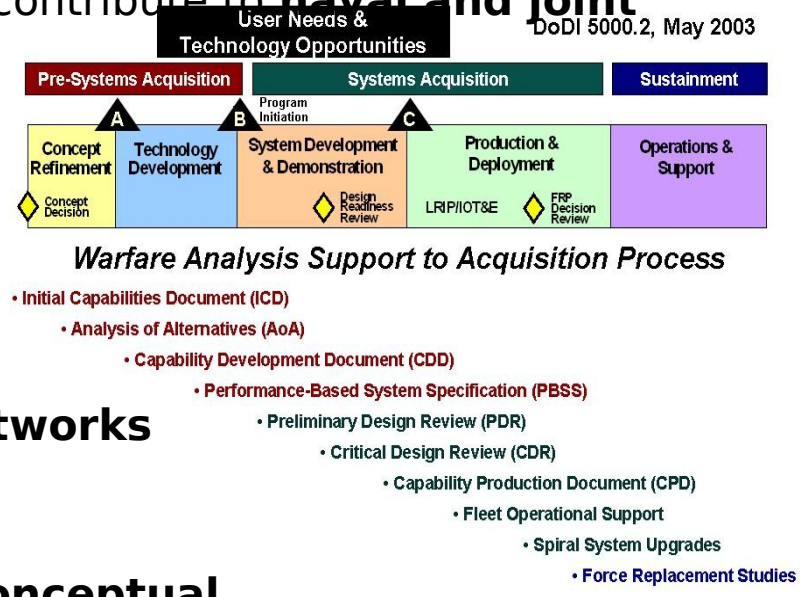
AIR-4.10's Role

- AIR 4.10 quantifies system and system-of-systems performance in operational context
  - What does a subsystem or component add to **mission capabilities**
  - How do systems and system-of-systems contribute to **naval and joint capabilities**

CAPABILITIES BASED ACQUISITION



AAW
ASW
STRIKE
ASuW
MIW
C4/ISR/Networks
IW/IO/EW
Lethality
Aircraft Conceptual Design



- Studies typically capture engineering performance and design in engagement, mission or campaign level M&S to assess capabilities and identify gaps
- M&S tools at appropriate resolution level are used to meet the customers needs

Annually Support 20 PMAS, OPNAV And The Fleet Providing 10-20 WY
In Each Warfare Area Shown Across The Acquisition Life Cycle

M&S-Based Analysis Process

1. Analysis Requirements

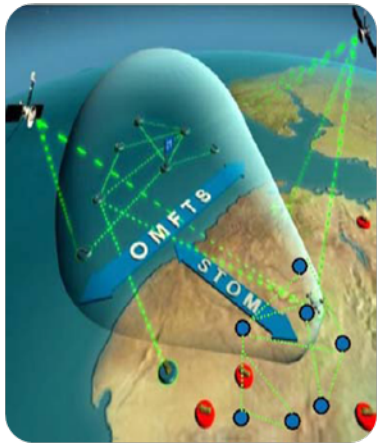
Initial or Follow-on

2. Scenario Information

Analysis Plan(s)

3. Model Requirements

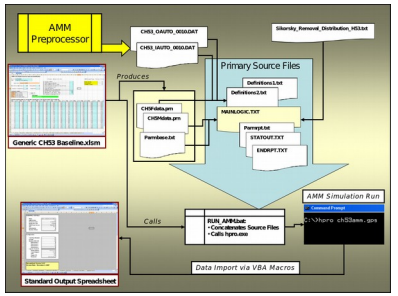
Analytic Baseline
Authoritative Data
Functional Architecture



4. Evaluate Model Capabilities

- Off-the-shelf Analytic Baseline
- Modify Analytic Baseline
- Develop New Analytic Baseline

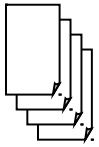
5. Execute Model



6. QA

Acceptability Criteria

7. Analysis End Results

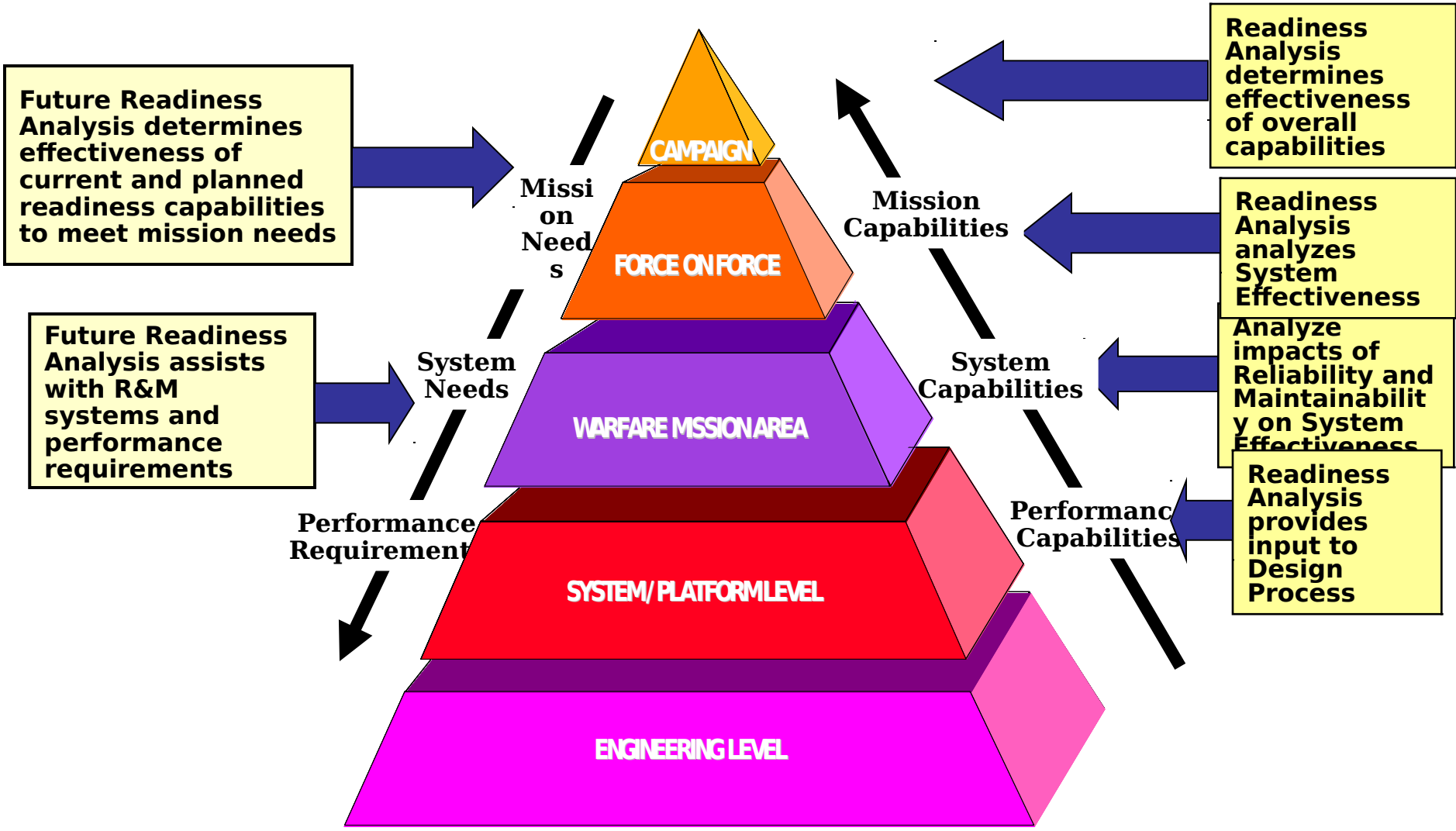


Analysis Documentation

- Conceptual
- Design
- Implementation
- Excursion Results

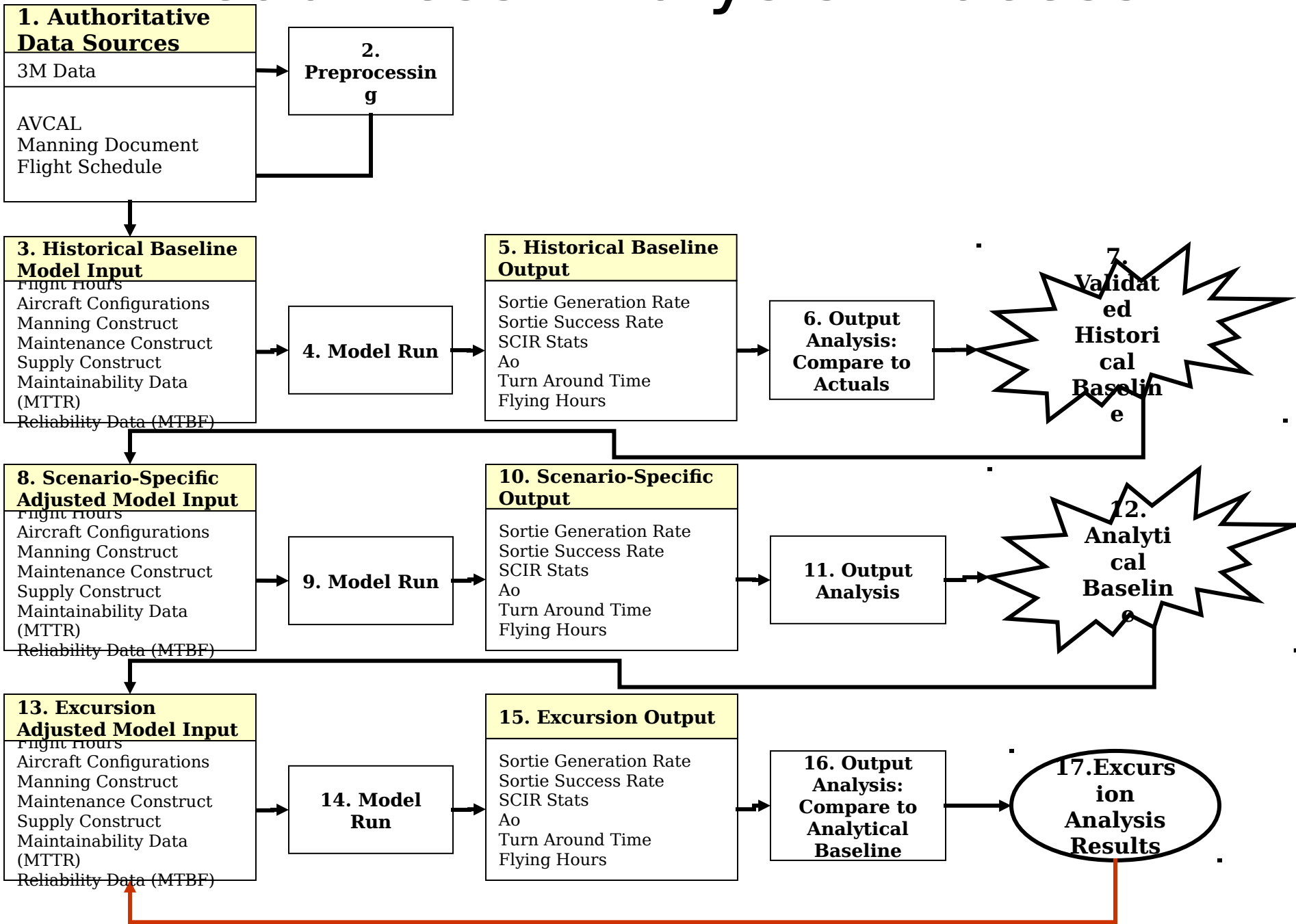
Model Configuration is Driven by the ANALYSIS REQUIREMENTS

Readiness Analysis Role


Future Readiness Analysis determines effectiveness of current and planned readiness capabilities to meet mission needs
Future Readiness Analysis assists with R&M systems and performance requirements
Missi on Need s
System Needs
Performance Requirement
CAMPAIGN
FORCE ON FORCE
WARFARE MISSION AREA
SYSTEM/ PLATFORM LEVEL
ENGINEERING LEVEL
Mission Capabilities
System Capabilities
Performanc Capabilities
Readiness Analysis determines effectiveness of overall capabilities
Readiness Analysis analyzes System Effectiveness
Analyze impacts of Reliability and Maintainabilit y on System Effectiveness
Readiness Analysis provides input to Design Process

*Unique for Naval Aviation Applications

Readiness Analysis Process



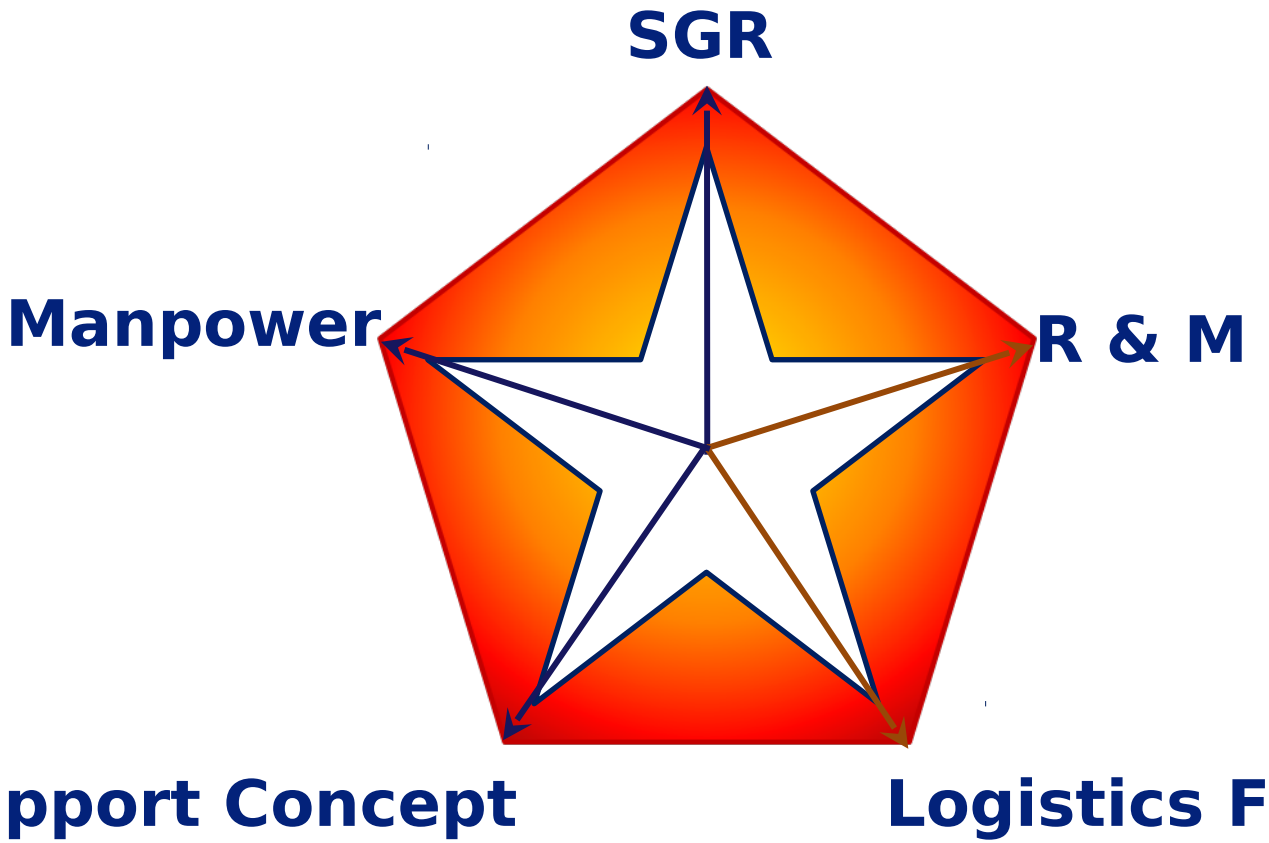
CH-53K Program Support

- **USMC Heavy Lift Helicopter**
- **Replaces the CH-53E**
- **USMC primary assault support platform**
- **NAVAIR PMA-261 Systems Design & Development (SDD) Program**
  - **Program Currently Post PDR**

H-53K Analytic Overview

- **Provides:**
  - Flight operations
  - Aircraft system failures
  - Resulting maintenance activity
  - Logistics support resource utiliza
- **The following activities and organizations are represented:**
  - 4, 8, 10, and 16 aircraft detachments
  - Scenario-specific flight schedules
  - R & M characteristics adjusted to reflect the evolving CH-53K design configuration
  - Maintenance support
  - Supply system support and AIMD throughput
    - Scenario Specific AVCALs
    - Appropriate pack-up-kits (PUKs) for specific detachments

Readiness Analytic Trade Study Space

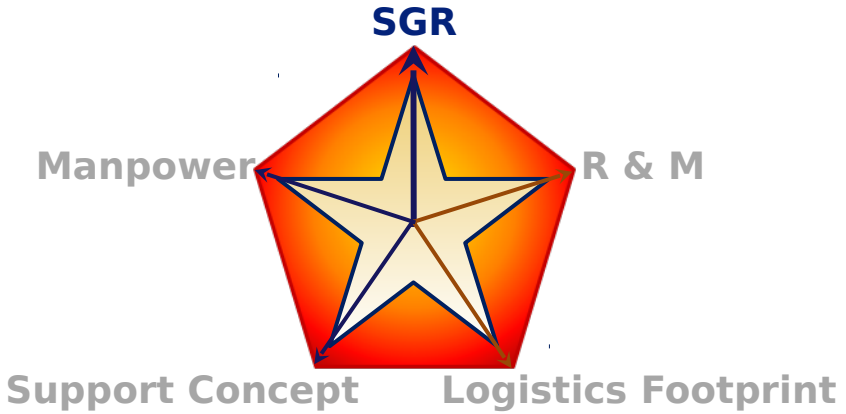


- *Early engagement with Program/Project*
- *Ability to grow and evolve with the program/project over time*
- *Provides analysis in an operation context*
- *Help reduce/mitigate risk*
- *Provides requirement verification to meet program/project objectives*
- *Ability to integrate necessary Subject Matter Expertise on an as needed basis (i.e. cost, R&M, etc)*

Analytic Trade Study Space

Sortie Generation Rate

- **Sortie Generation Rate (SGR) Sensitivity Analysis**
  - **Sortie Mission Demand Impact**
  - **R&M Characteristics Impact**
  - **Available Flight Window Impact**
  - **Supply Support Performance Impact**
  - **Manpower Impact Assessment**



Analytic Trade Study Space

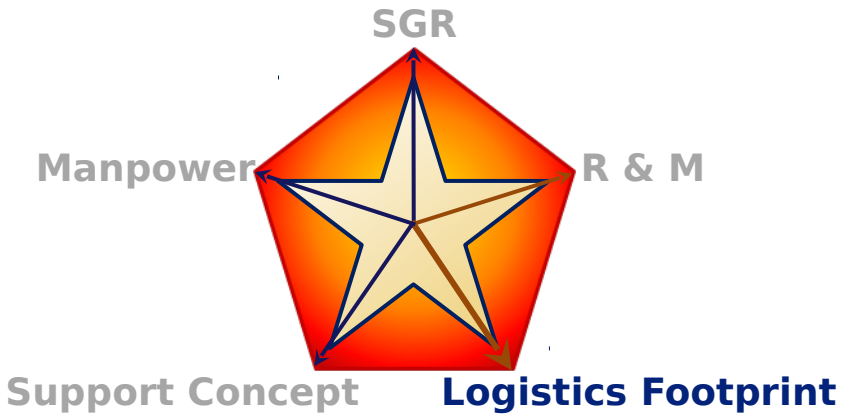
Reliability & Maintainability

- **R&M Risk Assessment Support**
  - **System Reliability**
    - **Identification of potential Not Mission Capable (NMC) drivers**
  - **System Maintainability**
  - **Engine Reliability Specification Modification Impact**
  - **Operational Mission Failure Analysis**
- **R&M Trend Analysis**
  - **Impact of updated engineering projections on other trade space parameters**
  - **Updated Analytic Baselines to support trade space analysis**

Analytic Trade Study Space

Logistics Footprint

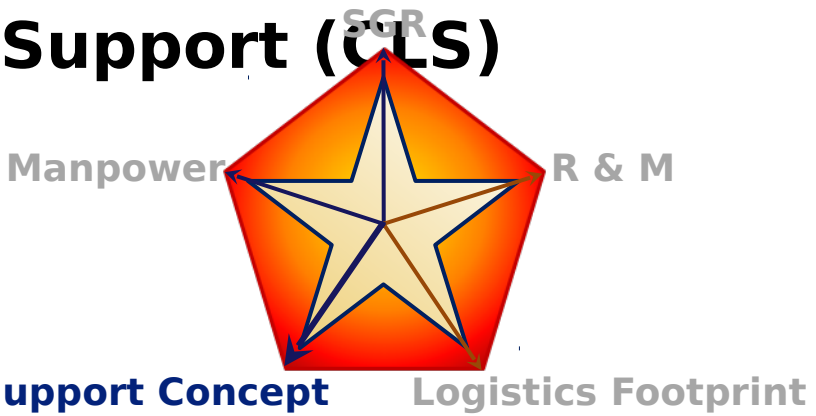
- **Footprint Element Range & Depth Sensitivity**
  - **Spares**
  - **Support Equipment**
  - **Mission Kits**
- **Extended Duration Footprint Requirements**



Analytic Trade Study Space

Support Concept

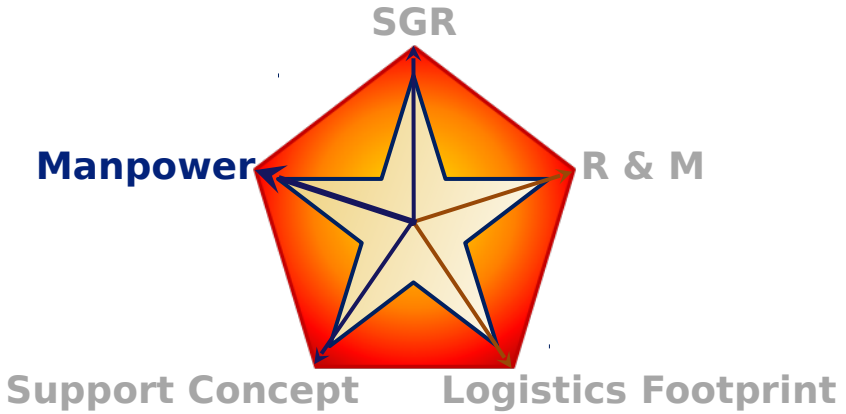
- **Sparing versus Repair**
- **Marine Aviation Logistics Support Program (MALSP) II**
  - **MALSP II versus MALSP**
- **Maintenance Concept**
  - **Organic**
  - **Hybrid**
  - **Contractor Logistics Support (CLS)**



Analytic Trade Study Space

Manpower

- **Manpower Resource Utilization**
  - **O-Level Work Center Manpower**
- **Work Center Allocation**
- **MOS Availability**
- **Aircrew Availability**



CH-53K AMM Analytic Baseline Output Metrics

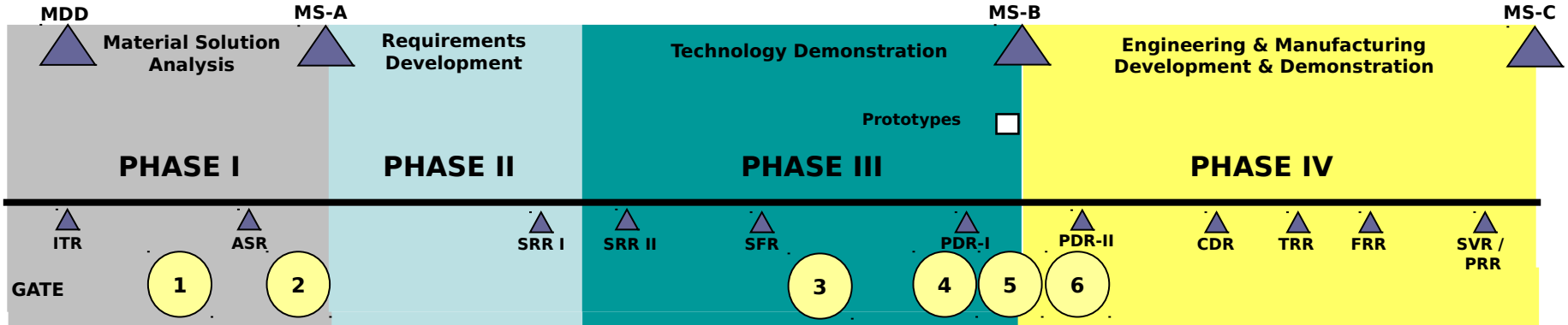
Scenario 3 - 4 Aircraft Deployed Historic Baseline Basic Metrics		Squadron1	Historical
Overall Sortie Generation Rate		0.46	
Day 1 SGR		0.76	
Sortie Success Rate		85%	
MMH/FH--total		28.6	42.8
% MC **		72.0%	65.8%
% FMC		57.3%	55.5%
% PMCM		9.6%	2.6%
% PMCS		5.1%	7.7%
% NMCMU		19.3%	11.9%
% NMCMS		1.4%	0.0%
% NMCS		7.3%	22.2%
Sorties Called		231	
Sorties Flown		197	202
On-Time Sorties		123	
Flight Hours		390.6	412.1
Initiated Maintenance Actions		1,689	1,823
Completed Maintenance Actions		1,590	
Number of OMFs Total		53	56
	NMC	26	
	PMC	27	
MFHBMA (Hrs)		0.2	
MFHBOMF (Hrs)		7.3	7.4
Average Daily MTTR (Hrs)		2.2	
MCMTOMF (Hrs)		0.79	
MMH--scheduled		1,395.2	5,572
MMH--unscheduled		9,775.1	12,056
MMH--total		11,170.3	17,628
MMH/FH--scheduled		3.6	13.5
MMH/FH--unscheduled		25.0	29.3
Cannibalizations		83.6	
Removals		260	240.0
Stockouts		95	
Supply Availability		63%	

- **Trade Space Metrics**
  - **Readiness Statistics**
    - **SGR/SSR**
    - **Mission Capability Statistics**
    - **RBA/RFT**
  - **R&M**
    - **No. of Unsched/Sched MAs/**
    - **No. of Operational Maintenance Failures**
    - **MFHBMA**
    - **MTTR/MCMTOMF**
  - **Logistics Footprint**
    - **Supply Availability %**
    - **No. of Stockouts**
    - **Item Demand**
  - **Support Concept**
    - **No. of Cannibalizations**
  - **Manpower**
    - **Unsched/Sched MMH**
    - **Work Center Utilization**

Project Examples

- **Littoral Combat Ship (LCS)**
  - Support Air 1.2 Ships Integration Team in evaluating compatibility of various deployed vertical air detachment logistic and support configurations within current and proposed LCS ship designs.
  - Identify MH-60R/S and RQ-8A degree of mission availability obtained through various support footprint alternatives and mission module reconfigurations
  - Provide Resource to Readiness and Sortie Success Rate metrics as a function of Manpower, Maintenance Concept, Supply, and Analysis
- **DD(X)**
  - Development of a set of metrics that will assist definition of innovative aviation maintenance and support concepts that will allow designated aircraft T/M/S to operate from the DD(X) and sustain high embarked aircraft availability and sustainability rates through the use of an optimized maintenance and support footprint
- **BAMS**
  - To demonstrate employment of the NAVAIR Readiness Analysis Capability to represent Broad Area Maritime Surveillance (BAMS) unmanned aircraft (UA) flight and maintenance operations and to support maintenance-related analysis.

SE Process MS&A Applicability



M&S Application

- Assist in defining technical framework as part of the CDD
- Analyze various Operational Concepts
- Analyze various Conceptual Designs
- Design Refinement
- Cost
- Enabling Technologies
- Risk Identification/Mitigation
- Rapid virtual Prototyping

Output

- M&S Configuration Management
- M&S Contractual for Data Rights/Access
- M&S interoperability and Reuse of data and models
- Inputs to the SEMP/SEP
- Inputs to the Test and Evaluation Strategy
- Development of the M&S Support Plan

M&S Application

Utilize M&S to assist in:

- The Reduction of Technology Risk
- Human-machine interface design considerations
- Physics-of-failure and Finite Element Analysis M&S
  - Stress analysis
  - Structural dynamics
  - Mass properties
  - Structural design materials
  - Fatigue, Loads and Shock isolation
  - Acoustics
- Identification of T&E data needed from test to further validate the M&S
- Development of Virtual prototypes

Output

MS&A based Inputs into:

- System Performances Specifications
  - TEMP
  - Updated SEP
  - Validated systems support
  - Lifecycle cost estimates
  - Manpower requirements

M&S Application

- Help build T&E hardware prototypes
- Assess areas of the mission space or performance envelope where:
  - Testing cannot be performed
  - Is not cost effective
  - Additional data is required
- Assess a system's capabilities and contributions to a FoS or SoS can be demonstrated
- Obtain final ergonomic modifications to the design With regard to HSI
- System representations for training end-users on the new system
- Final design trades and modifications before going into production

Output

- Identification of the required interfaces
- VV&A Models and Data Sets
- Evaluation of the performance/maturity of technology under development

Future Readiness In Pre-Milestone A Activities

WARFARE ANALYSIS & INTEGRATION DEPARTMENT

- **Concept Refinement Phase:**
  - Forecast the physical and operational maintenance environment of the proposed system
  - Given the forecasted environment, assess the functional characteristics of the proposed system, its complexity and the obstacles and enablers to effective sustainment in that environment
  - Begin compilation of information and requirements for logistics footprint reductions, deployment requirements, and other factors affecting the in-theater operational concept
  - Provide preliminary logistics requirements and capabilities into draft CDD
- **Technology Development Phase:**
  - Identify key performance and related support parameters for inclusion in the Capabilities Development Document (CDD)
  - Description of the product support strategy as documented in the Acquisition Strategy
  - Description of the appropriate logistics metrics, criteria, and funding requirements in the Acquisition Program Baseline (APB)
  - Include appropriate logistics considerations and test points in the Test and Evaluation Master Plan (TEMP)
  - Develop Rough Order of Magnitude (ROM) Life Cycle Cost estimates

Readiness Analysis in the SDD Phase

- **System Development and Demonstration (SDD) Phase:**
  - Support concept and strategy refined and potential PBL Product Support Integrator identified.
  - Reliability and Maintainability objectives clearly documented and corresponding Availability metrics clearly defined.
  - Iterative refinement of logistics support considerations corresponding with evolutionary acquisition strategy (when employed)
  - Include logistics and overall sustainment requirements in the Capabilities Production Document (CPD)
  - Demonstrate acceptable performance in development, test and evaluation, and operational assessment
  - Demonstrate system affordability and funding throughout the life cycle Production and Deployment Phase
  - Demonstrate satisfaction of sustainment criteria addressed in Initial Operational Test and Evaluation (IOT&E)
  - Ensure performance based logistics agreements are in place
  - Demonstrate a fully funded sustainment program
  - Conduct pre-initial operational capability (IOC) review
  - Confirm configuration control

Readiness Analysis in the Operations and Support Phase

- **Operations and Support Phase**
  - Validate sustainment strategies for iterative production increments in an evolutionary acquisition strategy
  - Participate in post-deployment reviews
  - Evaluate product support integrator/provider performance
  - Maintain strict configuration control procedures
  - Fleet requests and inquiry
  - PRL Investment Strategy
  - Fleet Support Team (FST) Analysis

Benefits

WARFARE ANALYSIS & INTEGRATION DEPARTMENT

- Projected Operational Readiness Tracking
  - Readiness Metric Determination
  - Readiness Visibility from ‘Concept to Operations and Support’
  - Ability to evaluate unique KPP performance
- Trade Space Analyses
  - Visualization/Understanding of Weapon System Design and Support Concepts
  - Evaluation Before Commitment
  - Definition/Evaluation of Innovative Support Strategies
- Infrastructure Change Impact Assessment
  - Aviation/Ship Integration
  - Readiness Impact of Resource distribution
  - Interoperability effectiveness
- Improved Return On Investment
  - Resource Investment Impact
  - Cost/Benefit Analysis Support
- Retained Data
  - Provides analytic baseline for updates and further excursions
  - Requirements tractability
- Improved Acquisition Program Resource Management
  - Provides the utility of having the discipline to slow down upfront and early “to get it right”
  - SETR Process Support
  - Risk Management and Reduction

QUESTIONS?